CLAIMS

What is claimed is:

1. An optical device, comprising:
a transmission optical waveguide; and
an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,
the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,
the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,
the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component.

2. The optical device of Claim 1, the transmission optical waveguide being a low-index optical waveguide.

3. The optical device of Claim 2, the transmission optical waveguide being a fiber-optic transmission waveguide, the fiber-optic transmission waveguide being adapted for transverse-coupling with the optical device component.

4. The optical device of Claim 3, the transmission fiber-optic waveguide being adapted for at least one of receiving optical signal power form a fiber-optic telecommunications system and transmitting optical signal power to a fiber-optic telecommunications system.

5. An optical device, comprising:
a transmission optical waveguide; and
an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the transmission fiber-optic waveguide including a fiber-optic-taper segment, the fiber-optic-taper segment being transverse-coupled to the optical device component.

6. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the transmission optical waveguide being a low-index planar lightwave transmission optical waveguide.

7. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure being adapted for passive modal-index-matching between the transmission optical waveguide and the multi-layer waveguide structure.

8. The optical device of Claim 7, the multi-layer waveguide structure including high-index material, the transmission optical waveguide being a low-index transmission optical waveguide.

9. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure

being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure being adapted for passive modal-index-matching between the transmission optical waveguide and the multi-layer waveguide structure,

the multi-layer waveguide including high-index material, the transmission optical waveguide being a transmission fiber-optic waveguide including a fiber-optic-taper segment, the fiber-optic-taper segment being transverse-coupled to the multi-layer waveguide structure.

10. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure being adapted for passive modal-index-matching between the transmission optical waveguide and the multi-layer waveguide structure,

the multi-layer waveguide structure including high-index material, the transmission optical waveguide being a low-index planar lightwave transmission optical waveguide.

11. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure being adapted for passive modal-index-matching between the transmission optical waveguide and the multi-layer waveguide structure,

the multi-layer waveguide structure being adapted for integration into an integrated optical device, the multi-layer waveguide structure being adapted for substantially completely transferring optical signal power between the transmission optical waveguide and the multi-layer waveguide structure, the multi-layer waveguide structure being thereby adapted to function as at least one of a passive input coupler and a passive output coupler between the transmission optical waveguide and the integrated optical device.

12. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure

being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including an active layer, the active layer including at least one of an electro-active layer and a non-linear-optical layer, the multi-layer waveguide structure being adapted so that varying a control signal applied to the active layer results in at least one of varying optical loss and varying modal-index for the multi-layer waveguide structure.

13. The optical device of Claim 12, the multi-layer waveguide structure including at least one electro-active layer, the electro-active layer including at least one of an electro-optic layer and an electro-absorptive layer, the multi-layer waveguide structure including a pair of electrical contact layers with the electro-active layer therebetween, the control signal being an electronic control signal applied through the electrical contact layers.

14. The optical device of Claim 12, the multi-layer waveguide structure including at least one non-linear-optical layer, the control signal being an optical control signal applied to the non-linear-optical layer.

15. The optical device of Claim 12, the multi-layer waveguide structure including high-index material, the transmission optical waveguide being a low-index transmission optical waveguide, the multi-layer waveguide structure being adapted for active modal-index-matching with the low-index transmission optical waveguide in response to the control signal.

16. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including an active layer, the active layer including at least one of an electro-active layer and a non-linear-optical layer, the multi-layer waveguide structure being adapted so that varying a control signal applied to the active layer results in at least one of varying optical loss and varying modal-index for the multi-layer waveguide structure,

the multi-layer waveguide including high-index material, the transmission optical waveguide being a transmission fiber-optic waveguide including a fiber-optic-taper segment, the fiber-optic-taper segment being transverse-coupled to the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for active modal-index-matching with the fiber-optic-taper segment in response to the control signal.

17. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure

being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including an active layer, the active layer including at least one of an electro-active layer and a non-linear-optical layer, the multi-layer waveguide structure being adapted so that varying a control signal applied to the active layer results in at least one of varying optical loss and varying modal-index for the multi-layer waveguide structure,

the multi-layer waveguide structure including high-index material, the transmission optical waveguide being a low-index planar lightwave transmission optical waveguide, the multi-layer waveguide structure being adapted for active modal-index-matching with the low-index planar lightwave transmission optical waveguide in response to the control signal.

18. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including an active layer, the active layer including at least one of an electro-active layer and a non-linear-optical layer, the multi-layer waveguide structure being adapted so that varying a control signal applied to the active

layer results in at least one of varying optical loss and varying modal-index for the multi-layer waveguide structure,

the multi-layer waveguide structure being adapted for integration into an integrated optical device, the multi-layer waveguide structure being adapted for substantially modal-index-matching with the transmission optical waveguide in response to the control signal so as to substantially completely transfer optical signal power between the transmission optical waveguide and the multi-layer waveguide structure in response to the control signal, the multi-layer waveguide structure being thereby adapted for functioning as at least one of an active input coupler and an active output coupler between the transmission optical waveguide and the integrated optical device.

19. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including an active layer, the active layer including at least one of an electro-active layer and a non-linear-optical layer, the multi-layer waveguide structure being adapted so that varying a control signal applied to the active layer results in at least one of varying optical loss and varying modal-index for the multi-layer waveguide structure,

the multi-layer waveguide structure being adapted for substantially completely transferring optical signal power between the transmission optical waveguide and the multi-layer waveguide structure in response to a first control signal level, the multi-layer waveguide structure being adapted for substantially preventing optical signal power transfer between the transmission optical waveguide and the multi-layer waveguide structure in response to a second control signal level, the optical device being thereby adapted for functioning as an optical switch.

20. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including an active layer, the active layer including at least one of an electro-active layer and a non-linear-optical layer, the multi-layer waveguide structure being adapted so that varying a control signal applied to the active layer results in at least one of varying optical loss and varying modal-index for the multi-layer waveguide structure,

the multi-layer waveguide structure being adapted for allowing substantially maximal transmission of optical signal power through the transmission optical waveguide in response to a first control signal level, the multi-layer waveguide structure being adapted allowing substantially minimal transmission of optical signal power through the

transmission optical waveguide in response to a second control signal level, the multi-layer waveguide structure being adapted for allowing an intermediate transmission level of optical signal power through the transmission optical waveguide in response to an intermediate control signal level, the optical device being thereby adapted for functioning as at least one of an optical modulator and a variable optical attenuator.

21. The optical device of Claim 20, the multi-layer waveguide structure being adapted for exhibiting varying modal-index in response to varying control signal level.

22. The optical device of Claim 20, the multi-layer waveguide structure being adapted for exhibiting varying optical loss in response to varying control signal level.

23. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer waveguide structure being substantially parallel to the substrate.

24. The optical device of Claim 23, the multi-layer reflector stack comprising a distributed Bragg reflector stack.

25. The optical device of Claim 23, the multi-layer waveguide structure being fabricated at least in part by deposition of layers on the substrate.

26. The optical device of Claim 23, the multi-layer waveguide structure including a single multi-layer reflector stack, the multi-layer waveguide structure being thereby adapted for guiding a surface-guided optical mode.

27. The optical device of Claim 23, the multi-layer waveguide structure including two multi-layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure being thereby adapted for guiding an optical mode along the core layer.

28. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer waveguide structure being substantially parallel to the substrate,

the multi-layer waveguide structure including a ridge-like waveguide structure protruding from the substrate formed by spatially-selective removal of material of lateral portions of the multi-layer waveguide structure.

29. The optical device of Claim 28, the material being removed substantially completely down to the substrate.

30. The optical device of Claim 28, the material being only partially removed.

31. The optical device of Claim 28, the material being removed substantially symmetrically from lateral portions of the multi-layer waveguide structure.

32. The optical device of Claim 28, the material being removed asymmetrically from lateral portions of the multi-layer waveguide structure.

33. The optical device of Claim 28, the transmission optical waveguide being transverse-coupled at a side surface of the multi-layer waveguide structure.

34. The optical device of Claim 28, the transmission optical waveguide being transverse-coupled at a top surface of the multi-layer waveguide structure.

35. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer waveguide structure being substantially parallel to the substrate,

at least one layer of the multi-layer waveguide structure being provided with a lateral lower-index portion.

36. The optical device of Claim 35, the lateral lower-index portion being provided on only one side of the multi-layer waveguide structure.

37. The optical device of Claim 35, the lateral lower-index portion being provided on both sides of the multi-layer waveguide structure.

38. The optical device of Claim 35, the lateral lower-index portion being provided by physical modification of at least one lateral portion of at least one layer.

39. An optical device, comprising:
a transmission optical waveguide; and
an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,
the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,
the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,
the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,
the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer waveguide structure being substantially parallel to the substrate,
at least one layer of the multi-layer waveguide structure being provided with a lateral lower-index portion,
the lateral lower-index portion being provided by deposition of lower-index material.

40. An optical device, comprising:
a transmission optical waveguide; and
an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,
the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer waveguide structure being substantially parallel to the substrate,

at least one layer of the multi-layer waveguide structure being provided with a lateral lower-index portion,

the lateral lower-index portion being provided by chemical modification of at least one lateral portion of at least one layer.

41. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer waveguide structure being substantially perpendicular to the substrate.

42. The optical device of Claim 41, the multi-layer reflector stack comprising a distributed Bragg reflector stack.

43. The optical device of Claim 41, the multi-layer waveguide structure including two multi-layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure being thereby adapted for guiding an optical mode along the core layer.

44. The optical device of Claim 41, the multi-layer waveguide structure being formed by spatially-selective processing of waveguide material deposited on the substrate.

45. The optical device of Claim 41, the transmission optical waveguide being transverse-coupled to the multi-layer waveguide structure at a side surface thereof.

46. The optical device of Claim 41, the transmission optical waveguide being transverse-coupled to the multi-layer waveguide structure at a top surface thereof.

47. The optical device of Claim 1, lateral confinement being provided by at least one lateral grating provided in at least one layer.

48. The optical device of Claim 1, the multi-layer waveguide structure including at least one dielectric multi-layer reflector stack.

49. The optical device of Claim 1, the multi-layer waveguide structure including at least one semi-conductor layer.

50. The optical device of Claim 49, the multi-layer waveguide structure including alternating higher-index GaAs and lower-index AlGaAs layers.

51. The optical device of Claim 50, at least one lower-index AlGaAs layer being provided with at least one lateral aluminum oxide portion.

52. The optical device of Claim 49, the multi-layer waveguide structure including alternating higher-index AlGaAs and lower-index aluminum oxide layers.

53. The optical device of Claim 52, at least one higher-index AlGaAs layer being provided with at least one lateral aluminum oxide portion.

54. The optical device of Claim 49, the multi-layer waveguide structure including alternating higher-index InP and lower-index InAlAs layers.

55. The optical device of Claim 54, at least one lower-index InAlAs layer being provided with at least one lateral aluminum oxide portion.

56. The optical device of Claim 49, the multi-layer waveguide structure including alternating higher-index InAlAs and lower-index aluminum oxide layers.

57. The optical device of Claim 56, at least one higher-index InAlAs layer being provided with at least one lateral aluminum oxide portion.

58. The optical device of Claim 49, the multi-layer waveguide structure including alternating higher-index InP and lower-index aluminum oxide layers.

59. The optical device of Claim 49, the multi-layer waveguide structure including alternating higher-index GaAs and lower-index aluminum oxide layers.

60. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including alternating higher-index semiconductor and lower-index semiconductor layers.

61. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including alternating higher-index semiconductor and lower-index semiconductor layers,

at least one of the higher-index semiconductor layers and the lower-index semi-conductor layers being provided with at least one lateral oxidized portion.

62. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including alternating higher-index semiconductor and lower-index oxide layers.

63. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including alternating higher-index semiconductor and lower-index oxide layers,

at least one higher-index semiconductor layer being provided with at least one lateral oxidized portion.

64. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

at least one layer of the multi-layer waveguide structure including an aluminum-containing semiconductor.

65. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

at least one layer of the multi-layer waveguide structure being provided with at least one lateral aluminum oxide portion.

66. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including at least one semiconductor active layer.

67. The optical device of Claim 66, at least one semiconductor active layer being lattice-compatible with the multi-layer reflector stack.

68. The optical device of Claim 66, at least one semiconductor active layer being lattice-incompatible with the multi-layer reflector stack.

69. The optical device of Claim 66, at least one semiconductor active layer being an InGaAs layer.

70. The optical device of Claim 66, at least one semiconductor active layer being an InGaAsP layer.

71. The optical device of Claim 66, at least one semiconductor active layer being an InGaAsN layer.

72. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including at least one semiconductor active layer,

at least one semiconductor active layer being an electro-absorptive layer.

73. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including at least one semiconductor active layer,

at least one semiconductor active layer being an electro-optic layer.

74. An optical device, comprising:

a transmission optical waveguide; and

an optical device component transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical device component including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack,

the optical device component being transverse-coupled to the transmission optical waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling modal-index-matching between the transmission optical waveguide and the optical device component,

the multi-layer waveguide structure including at least one semiconductor active layer,

at least one semiconductor layer being a non-linear-optic layer.

75. An optical modulator, comprising:

an input optical waveguide;

an output optical waveguide;

a first intermediate optical waveguide connecting the input and output optical waveguides; and

a second intermediate optical waveguide connecting the input and output optical waveguides,

the input optical waveguide being adapted for receiving optical signal power from an optical signal transmission system, for dividing the received optical signal power into first and second optical signal power fractions, and for transmitting the first and second optical signal power fractions to the first and second intermediate optical waveguides, respectively,

the output optical waveguide being adapted for receiving and recombining the first and second optical signal power fractions from the first and second intermediate optical waveguides, respectively,

the output optical waveguide being adapted for substantially maximally transmitting the recombined optical signal power to the optical transmission system when the recombined first and second optical signal fractions substantially constructively interfere, and for substantially minimally transmitting the recombined optical signal power to the optical transmission system when the recombined first and second optical signal fractions substantially destructively interfere,

the input waveguide, output waveguide, first intermediate waveguide, and second intermediate waveguide each comprising a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

at least one of the first and second intermediate waveguides being adapted for receiving the control signal,

the multi-layer waveguide structure being adapted so that varying the control signal applied to at least one of the first and second intermediate waveguides results in a varying modal-index, thereby enabling control of interference between the recombined first and second optical signal power fractions at the output waveguide.

76. An optical modulator, comprising:

an input optical waveguide;

an output optical waveguide;

a first intermediate optical waveguide connecting the input and output optical waveguides; and

a second intermediate optical waveguide connecting the input and output optical waveguides,

the input waveguide, output waveguide, first intermediate waveguide, and second intermediate waveguide each including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to a varying applied control signal,

at least one of the first and second intermediate waveguides being adapted for receiving the control signal,

the input optical waveguide being adapted for receiving optical signal power from an optical signal transmission system, for dividing the received optical signal power into first and second optical signal power fractions, and for transmitting the first and second optical

signal power fractions to the first and second intermediate optical waveguides, respectively,

the output optical waveguide being adapted for receiving and recombining the first and second optical signal power fractions from the first and second intermediate optical waveguides, respectively, and transmitting the recombined fractions to the optical signal transmission system,

the optical modulator being thereby adapted so that varying the control signal level results in a varying level of transmission of the recombined fractions to the optical signal transmission system.

77. The optical modulator of Claim 76, the active layer including at least one electro-active layer, the electro-active layer including at least one of an electro-optic layer and an electro-absorptive layer, at least one of the intermediate waveguides including a pair of electrical contacts with the electro-active layer therebetween, the control signal being an electrical control signal applied through the electrical contacts.

78. The optical modulator of Claim 76, the active layer including at least one non-linear optical layer, the control signal being an optical control signal applied to a portion of the non-linear-optical layer in at least one of the intermediate waveguides.

79. The optical modulator of Claim 76, the multi-layer waveguide structure including a single multi-layer waveguide stack, the multi-layer waveguide structure being thereby adapted for guiding a surface-guided optical mode.

80. The optical modulator of Claim 76, the multi-layer waveguide structure including two multi-layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure being thereby adapted for guiding an optical mode along the core layer.

81. The optical modulator of Claim 76, the input optical waveguide being adapted for receiving optical signal power from the optical signal transmission system by end-coupling, the output optical waveguide being adapted for transmitting optical signal power to the optical signal transmission system by end-coupling.

82. An optical modulator, comprising:

an input optical waveguide;

an output optical waveguide;

a first intermediate optical waveguide connecting the input and output optical waveguides; and

a second intermediate optical waveguide connecting the input and output optical waveguides,

the input waveguide, output waveguide, first intermediate waveguide, and second intermediate waveguide each including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to a varying applied control signal,

at least one of the first and second intermediate waveguides being adapted for receiving the control signal,

the input optical waveguide being adapted for receiving optical signal power from an optical signal transmission system, for dividing the received optical signal power into first and second optical signal power fractions, and for transmitting the first and second optical signal power fractions to the first and second intermediate optical waveguides, respectively,

the output optical waveguide being adapted for receiving and recombining the first and second optical signal power fractions from the first and second intermediate optical waveguides, respectively, and transmitting the recombined fractions to the optical signal transmission system,

the optical modulator being thereby adapted so that varying the control signal level results in a varying level of transmission of the recombined fractions to the optical signal transmission system,

the input optical waveguide being adapted for receiving optical signal power from the optical signal transmission system by transverse-coupling to a transmission optical waveguide, the output optical waveguide being adapted for transmitting optical signal power to the optical signal transmission system by transverse-coupling to a transmission optical waveguide.

83. The optical modulator of Claim 82, the multi-layer waveguide structure including a high-index material.

84. The optical modulator of Claim 82, the transmission optical waveguide being a low-index transmission optical waveguide, the low-index waveguide being adapted for transverse-coupling.

85. The optical modulator of Claim 82, the transmission optical waveguide being a transmission fiber-optic waveguide, the transmission fiber-optic waveguide being adapted for transverse-coupling.

86. An optical modulator, comprising:
an input optical waveguide;
an output optical waveguide;
a first intermediate optical waveguide connecting the input and output optical waveguides; and
a second intermediate optical waveguide connecting the input and output optical waveguides,
the input waveguide, output waveguide, first intermediate waveguide, and second intermediate waveguide each including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to a varying applied control signal,
at least one of the first and second intermediate waveguides being adapted for receiving the control signal,
the input optical waveguide being adapted for receiving optical signal power from an optical signal transmission system, for dividing the received optical signal power into first and second optical signal power fractions, and for transmitting the first and second optical signal power fractions to the first and second intermediate optical waveguides, respectively,
the output optical waveguide being adapted for receiving and recombining the first and second optical signal power fractions from the first and second intermediate optical

waveguides, respectively, and transmitting the recombined fractions to the optical signal transmission system,

the optical modulator being thereby adapted so that varying the control signal level results in a varying level of transmission of the recombined fractions to the optical signal transmission system,

the input optical waveguide being adapted for receiving optical signal power from the optical signal transmission system by transverse-coupling to a transmission optical waveguide, the output optical waveguide being adapted for transmitting optical signal power to the optical signal transmission system by transverse-coupling to a transmission optical waveguide,

the transmission optical waveguide being a transmission fiber-optic waveguide including a fiber-optic-taper segment, the fiber-optic-taper segment being adapted for transverse-coupling.

87. An optical modulator, comprising:

an input optical waveguide;

an output optical waveguide;

a first intermediate optical waveguide connecting the input and output optical waveguides; and

a second intermediate optical waveguide connecting the input and output optical waveguides,

the input waveguide, output waveguide, first intermediate waveguide, and second intermediate waveguide each including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to a varying applied control signal,

at least one of the first and second intermediate waveguides being adapted for receiving the control signal,

the input optical waveguide being adapted for receiving optical signal power from an optical signal transmission system, for dividing the received optical signal power into first and

second optical signal power fractions, and for transmitting the first and second optical signal power fractions to the first and second intermediate optical waveguides, respectively,

the output optical waveguide being adapted for receiving and recombining the first and second optical signal power fractions from the first and second intermediate optical waveguides, respectively, and transmitting the recombined fractions to the optical signal transmission system,

the optical modulator being thereby adapted so that varying the control signal level results in a varying level of transmission of the recombined fractions to the optical signal transmission system,

the input optical waveguide being adapted for receiving optical signal power from the optical signal transmission system by transverse-coupling to a transmission optical waveguide, the output optical waveguide being adapted for transmitting optical signal power to the optical signal transmission system by transverse-coupling to a transmission optical waveguide,

the transmission optical waveguide being a low-index planar lightwave transmission optical waveguide, the planar lightwave transmission optical waveguide being adapted for transverse-coupling.

88. An optical modulator, comprising:

a transmission optical waveguide, the transmission optical waveguide including a first transverse-coupling segment, an intermediate segment, and a second transverse-coupling segment; and

a modulator optical waveguide, the modulator optical waveguide including a first transverse-coupling segment, an intermediate segment, and a second transverse-coupling segment,

the transmission optical waveguide and the modulator optical waveguide being transverse-coupled at the respective first transverse-coupling segments thereof,

the transmission optical waveguide and the modulator optical waveguide being transverse-coupled at the respective second transverse-coupling segments thereof,

the transmission optical waveguide being adapted for receiving optical signal power from an optical signal transmission system into the first transverse-coupling segment thereof,

the first transverse-coupling segment of the transmission optical waveguide and the first transverse-coupling segment of the modulator optical waveguide being adapted for dividing, via transverse optical coupling therebetween, the received optical signal power into a modulator waveguide fraction and a transmission waveguide fraction, and for transmitting the fractions to the respective intermediate waveguide segments,

the second transverse-coupling segment of the transmission optical waveguide and the second transverse-coupling segment of the modulator optical waveguide being adapted for receiving and recombining, via transverse optical coupling, the modulator waveguide fraction and the transmission waveguide fraction,

the second transverse-coupling segment of the transmission optical waveguide and the second transverse-coupling segment of the modulator optical waveguide being adapted for substantially maximally transmitting the recombined optical signal power to the optical signal transmission system when the recombined modulator waveguide fraction and transmission waveguide fraction substantially constructively interfere in the transmission optical waveguide, and for substantially minimally transmitting the recombined optical signal power to the optical signal transmission system when the recombined modulator waveguide fraction and transmission waveguide fraction substantially destructively interfere in the transmission optical waveguide,

the modulator optical waveguide comprising a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the multi-layer waveguide structure being adapted so that varying the control signal applied to the intermediate waveguide segment results in a varying modal-index, thereby enabling control of interference between the recombined modulator waveguide fraction and transmission waveguide fraction in the transmission optical waveguide.

89. An optical modulator, comprising:

a transmission optical waveguide, the transmission optical waveguide including a first transverse-coupling segment, an intermediate segment, and a second transverse-coupling segment; and

a modulator optical waveguide, the modulator optical waveguide including a first transverse-coupling segment, an intermediate segment, and a second transverse-coupling segment,

the transmission optical waveguide and the modulator optical waveguide being transverse-coupled at the respective first transverse-coupling segments thereof,

the transmission optical waveguide and the modulator optical waveguide being transverse-coupled at the respective second transverse-coupling segments thereof,

the transmission optical waveguide being adapted for receiving optical signal power from an optical signal transmission system into the first transverse-coupling segment thereof,

the modulator optical waveguide comprising a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the first transverse-coupling segment of the transmission optical waveguide and the first transverse-coupling segment of the modulator optical waveguide being adapted for dividing, via transverse optical coupling therebetween, the received optical signal power into a modulator waveguide fraction and a transmission waveguide fraction, and for transmitting the fractions to the respective intermediate waveguide segments,

the second transverse-coupling segment of the transmission optical waveguide and the second transverse-coupling segment of the modulator optical waveguide being adapted for receiving, and recombining via transverse optical coupling the modulator waveguide fraction and the transmission waveguide fraction, and transmitting the recombined fractions to the optical signal transmission system,

the multi-layer waveguide structure being adapted so that varying the control signal applied to the intermediate waveguide segment results in a varying level of transmission of the recombined fractions to the optical signal transmission system.

90. The optical modulator of Claim 89, the active layer including at least one electro-active layer, the electro-active layer including at least one of an electro-optic layer and an electro-absorptive layer, the intermediate segment of the modulator optical waveguide including a pair of electrical contacts with the electro-active layer therebetween, the control signal being an electrical control signal applied through the electrical contacts.

91. The optical modulator of Claim 89, the active layer including at least one non-linear optical layer, the control signal being an optical control signal applied to a portion of the non-linear-optical layer in the intermediate segment of the modulator optical waveguide.

92. The optical modulator of Claim 89, the multi-layer waveguide structure including a single multi-layer waveguide stack, the multi-layer waveguide structure being thereby adapted for guiding a surface-guided optical mode.

93. The optical modulator of Claim 89, the multi-layer waveguide structure including two multi-layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure being thereby adapted for guiding an optical mode along the core layer.

94. The optical modulator of Claim 89, the first transverse-coupling segment of the transmission optical waveguide and the first transverse-coupling segment of the modulator optical waveguide being passively substantially modal-index-matched, the second transverse-coupling segment of the transmission optical waveguide and the second transverse-coupling segment of the modulator optical waveguide being passively substantially modal-index-matched.

95. The optical modulator of Claim 89, the first transverse-coupling segment of the transmission optical waveguide and the first transverse-coupling segment of the modulator optical waveguide being actively substantially modal-index-matched by applying an input control signal to the active layer in the first transverse-coupling segment of the modulator optical waveguide, the second transverse-coupling segment of the transmission optical waveguide and the second transverse-coupling segment of the modulator optical waveguide being actively substantially modal-index-matched by applying an output control signal to the active layer in the second transverse-coupling segment of the modulator optical waveguide.

96. The optical modulator of Claim 89, the multi-layer waveguide structure including a high-index material.

97. The optical modulator of Claim 89, the transmission optical waveguide being a low-index transmission optical waveguide, the low-index waveguide being adapted for transverse-coupling.

98. The optical modulator of Claim 89, the transmission optical waveguide being a transmission fiber-optic waveguide, the transmission fiber-optic waveguide being adapted for transverse-coupling.

99. An optical modulator, comprising:

a transmission optical waveguide, the transmission optical waveguide including a first transverse-coupling segment, an intermediate segment, and a second transverse-coupling segment; and

a modulator optical waveguide, the modulator optical waveguide including a first transverse-coupling segment, an intermediate segment, and a second transverse-coupling segment,

the transmission optical waveguide and the modulator optical waveguide being transverse-coupled at the respective first transverse-coupling segments thereof,

the transmission optical waveguide and the modulator optical waveguide being transverse-coupled at the respective second transverse-coupling segments thereof,

the transmission optical waveguide being adapted for receiving optical signal power from an optical signal transmission system into the first transverse-coupling segment thereof,

the modulator optical waveguide comprising a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the first transverse-coupling segment of the transmission optical waveguide and the first transverse-coupling segment of the modulator optical waveguide being adapted for dividing, via transverse optical coupling therebetween, the received optical signal power

into a modulator waveguide fraction and a transmission waveguide fraction, and for transmitting the fractions to the respective intermediate waveguide segments,

the second transverse-coupling segment of the transmission optical waveguide and the second transverse-coupling segment of the modulator optical waveguide being adapted for receiving, and recombining via transverse optical coupling the modulator waveguide fraction and the transmission waveguide fraction, and transmitting the recombined fractions to the optical signal transmission system,

the multi-layer waveguide structure being adapted so that varying the control signal applied to the intermediate waveguide segment results in a varying level of transmission of the recombined fractions to the optical signal transmission system,

the transmission optical waveguide being a transmission fiber-optic waveguide including a fiber-optic-taper segment, the fiber-optic-taper segment being adapted for transverse-coupling.

100. An optical modulator, comprising:

a transmission optical waveguide, the transmission optical waveguide including a first transverse-coupling segment, an intermediate segment, and a second transverse-coupling segment; and

a modulator optical waveguide, the modulator optical waveguide including a first transverse-coupling segment, an intermediate segment, and a second transverse-coupling segment,

the transmission optical waveguide and the modulator optical waveguide being transverse-coupled at the respective first transverse-coupling segments thereof,

the transmission optical waveguide and the modulator optical waveguide being transverse-coupled at the respective second transverse-coupling segments thereof,

the transmission optical waveguide being adapted for receiving optical signal power from an optical signal transmission system into the first transverse-coupling segment thereof,

the modulator optical waveguide comprising a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for

exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the first transverse-coupling segment of the transmission optical waveguide and the first transverse-coupling segment of the modulator optical waveguide being adapted for dividing, via transverse optical coupling therebetween, the received optical signal power into a modulator waveguide fraction and a transmission waveguide fraction, and for transmitting the fractions to the respective intermediate waveguide segments,

the second transverse-coupling segment of the transmission optical waveguide and the second transverse-coupling segment of the modulator optical waveguide being adapted for receiving, and recombining via transverse optical coupling the modulator waveguide fraction and the transmission waveguide fraction, and transmitting the recombined fractions to the optical signal transmission system,

the multi-layer waveguide structure being adapted so that varying the control signal applied to the intermediate waveguide segment results in a varying level of transmission of the recombined fractions to the optical signal transmission system,

the transmission optical waveguide being a low-index planar lightwave transmission optical waveguide, the planar lightwave transmission optical waveguide being adapted for transverse-coupling.

101. An optical switch, comprising:

a first optical waveguide, the first optical waveguide including an input segment, a transverse-coupling segment, and an output segment; and

a second optical waveguide, the second optical waveguide including an input segment, a transverse-coupling segment, and an output segment,

the first and second optical waveguides being transverse-coupled at the respective transverse-coupling segments thereof,

the input segments of the first and second optical waveguides each being adapted for receiving optical signal power from an optical signal transmission system and transmitting received optical signal power to the respective transverse-coupling segment,

the output segments of the first and second optical waveguides each being adapted for receiving optical signal power from the respective transverse-coupling segments and transmitting the optical signal power to the optical signal transmission system,

the first and second optical waveguides each comprising a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the multi-layer waveguide structure being adapted so that varying the control signal applied to at least one of the transverse-coupling segments results in optical signal power transfer between the first and second transmission optical waveguides.

102. The optical switch of Claim 101, the active layer including at least one electro-active layer, the electro-active layer including at least one of an electro-optic layer and an electro-absorptive layer, the transverse coupling segment of at least one of the optical waveguides including a pair of electrical contacts with the electro-active layer therebetween, the control signal being an electrical control signal applied through the electrical contacts.

103. The optical switch of Claim 101, the active layer including at least one non-linear optical layer, the control signal being an optical control signal applied to a portion of the non-linear-optical layer in the transverse-coupling segment of at least one of the optical waveguides.

104. The optical switch of Claim 101, the multi-layer waveguide structure including a single multi-layer waveguide stack, the multi-layer waveguide structure being thereby adapted for guiding a surface-guided optical mode.

105. The optical switch of Claim 101, the multi-layer waveguide structure including two multi-layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure being thereby adapted for guiding an optical mode along the core layer.

106. The optical switch of Claim 101, the input segments of the first and second optical waveguides being adapted for receiving optical signal power from the optical signal transmission system by end-coupling, the output segments of the first and second optical

waveguides being adapted for transmitting optical signal power to the optical signal transmission system by end-coupling.

107. An optical switch, comprising:

a first optical waveguide, the first optical waveguide including an input segment, a transverse-coupling segment, and an output segment; and

a second optical waveguide, the second optical waveguide including an input segment, a transverse-coupling segment, and an output segment,

the first and second optical waveguides being transverse-coupled at the respective transverse-coupling segments thereof,

the input segments of the first and second optical waveguides each being adapted for receiving optical signal power from an optical signal transmission system and transmitting received optical signal power to the respective transverse-coupling segment,

the output segments of the first and second optical waveguides each being adapted for receiving optical signal power from the respective transverse-coupling segments and transmitting the optical signal power to the optical signal transmission system,

the first and second optical waveguides each comprising a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the multi-layer waveguide structure being adapted so that varying the control signal applied to at least one of the transverse-coupling segments results in optical signal power transfer between the first and second transmission optical waveguides,

the input segments of the first and second optical waveguides being adapted for receiving optical signal power from the optical signal transmission system by transverse-coupling to a transmission optical waveguide, the output segments of the first and second optical waveguides being adapted for transmitting optical signal power to the optical signal transmission system by transverse coupling to a transmission optical waveguide.

108. The optical switch of Claim 107, the multi-layer waveguide structure including a high-index material.

109. The optical switch of Claim 107, the transmission optical waveguide being a low-index transmission optical waveguide, the low-index waveguide being adapted for transverse-coupling.

110. The optical switch of Claim 107, the transmission optical waveguide being a transmission fiber-optic waveguide, the transmission fiber-optic waveguide being adapted for transverse-coupling.

111. An optical switch, comprising:

a first optical waveguide, the first optical waveguide including an input segment, a transverse-coupling segment, and an output segment; and

a second optical waveguide, the second optical waveguide including an input segment, a transverse-coupling segment, and an output segment,

the first and second optical waveguides being transverse-coupled at the respective transverse-coupling segments thereof,

the input segments of the first and second optical waveguides each being adapted for receiving optical signal power from an optical signal transmission system and transmitting received optical signal power to the respective transverse-coupling segment,

the output segments of the first and second optical waveguides each being adapted for receiving optical signal power from the respective transverse-coupling segments and transmitting the optical signal power to the optical signal transmission system,

the first and second optical waveguides each comprising a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the multi-layer waveguide structure being adapted so that varying the control signal applied to at least one of the transverse-coupling segments results in optical signal power transfer between the first and second transmission optical waveguides,

the input segments of the first and second optical waveguides being adapted for receiving optical signal power from the optical signal transmission system by transverse-coupling to a transmission optical waveguide, the output segments of the first and second optical waveguides being adapted for transmitting optical signal power to the optical signal transmission system by transverse coupling to a transmission optical waveguide,

the transmission optical waveguide being a transmission fiber-optic waveguide including a fiber-optic-taper segment, the fiber-optic-taper segment being adapted for transverse-coupling.

112. An optical switch, comprising:

a first optical waveguide, the first optical waveguide including an input segment, a transverse-coupling segment, and an output segment; and

a second optical waveguide, the second optical waveguide including an input segment, a transverse-coupling segment, and an output segment,

the first and second optical waveguides being transverse-coupled at the respective transverse-coupling segments thereof,

the input segments of the first and second optical waveguides each being adapted for receiving optical signal power from an optical signal transmission system and transmitting received optical signal power to the respective transverse-coupling segment,

the output segments of the first and second optical waveguides each being adapted for receiving optical signal power from the respective transverse-coupling segments and transmitting the optical signal power to the optical signal transmission system,

the first and second optical waveguides each comprising a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the multi-layer waveguide structure being adapted so that varying the control signal applied to at least one of the transverse-coupling segments results in optical signal power transfer between the first and second transmission optical waveguides,

the input segments of the first and second optical waveguides being adapted for receiving optical signal power from the optical signal transmission system by transverse-coupling to a transmission optical waveguide, the output segments of the first and second optical waveguides being adapted for transmitting optical signal power to the optical signal transmission system by transverse coupling to a transmission optical waveguide,

the transmission optical waveguide being a low-index planar lightwave transmission optical waveguide, the planar lightwave transmission optical waveguide being adapted for transverse-coupling.

113. A resonant optical device, comprising:

a transmission optical waveguide; and

an optical resonator transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical resonator including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the optical resonator being transverse-coupled to the transmission optical waveguide through the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling control, by application of a control signal, of at least one of optical signal power transfer between the transmission optical waveguide and the optical resonator, a resonant frequency of the optical resonator, and optical loss of the optical resonator, thereby further enabling modulation of transmission of optical signal power through the transmission optical waveguide when the optical signal is substantially resonant with the optical resonator.

114. The optical modulator of Claim 113, the active layer including at least one electro-active layer, the electro-active layer including at least one of an electro-optic layer and an electro-

absorptive layer, the optical resonator including a pair of electrical contacts with at least a portion of the electro-active layer therebetween, the control signal being an electrical control signal applied through the electrical contacts.

115. The optical modulator of Claim 113, the active layer including at least one non-linear optical layer, the control signal being an optical control signal applied to the non-linear-optical layer in at least a portion of the optical resonator.

116. The optical modulator of Claim 113, the multi-layer waveguide structure including a single multi-layer waveguide stack, the multi-layer waveguide structure being thereby adapted for guiding a surface-guided optical mode.

117. The optical modulator of Claim 113, the multi-layer waveguide structure including two multi-layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure being thereby adapted for guiding an optical mode along the core layer.

118. The optical modulator of Claim 113, the optical resonator and the transmission optical waveguide being passively substantially modal-index-matched at respective transverse-coupling segments thereof.

119. The optical modulator of Claim 113, the optical resonator and the transmission optical waveguide being actively substantially modal-index-matched at respective transverse-coupling segments thereof by applying a control signal to the active layer in the transverse-coupling segment of the optical resonator.

120. The optical modulator of Claim 113, the multi-layer waveguide structure including a high-index material.

121. The optical modulator of Claim 113, the transmission optical waveguide being a low-index transmission optical waveguide, the low-index waveguide being adapted for transverse-coupling.

122. The optical modulator of Claim 113, the transmission optical waveguide being a transmission fiber-optic waveguide, the transmission fiber-optic waveguide being adapted for transverse-coupling.

123. A resonant optical device, comprising:

a transmission optical waveguide; and

an optical resonator transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical resonator including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the optical resonator being transverse-coupled to the transmission optical waveguide through the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling control, by application of a control signal, of at least one of optical signal power transfer between the transmission optical waveguide and the optical resonator, a resonant frequency of the optical resonator, and optical loss of the optical resonator, thereby further enabling modulation of transmission of optical signal power through the transmission optical waveguide when the optical signal is substantially resonant with the optical resonator,

the transmission optical waveguide being a transmission fiber-optic waveguide including a fiber-optic-taper segment, the fiber-optic-taper segment being adapted for transverse-coupling.

124. A resonant optical device, comprising:

a transmission optical waveguide; and

an optical resonator transverse-coupled to the transmission optical waveguide so as to enable optical signal power transfer therebetween,

the transmission optical waveguide being adapted for at least one of receiving optical signal power from an optical signal transmission system and transmitting optical signal power to the optical signal transmission system,

the optical resonator including a laterally-confined multi-layer dispersion-engineered waveguide structure, the multi-layer waveguide structure including at least one multi-layer reflector stack and at least one active layer, the active layer being adapted for exhibiting at least one of varying optical loss and varying modal-index in response to an applied control signal,

the optical resonator being transverse-coupled to the transmission optical waveguide through the multi-layer waveguide structure, the multi-layer waveguide structure being adapted for enabling control, by application of a control signal, of at least one of optical signal power transfer between the transmission optical waveguide and the optical resonator, a resonant frequency of the optical resonator, and optical loss of the optical resonator, thereby further enabling modulation of transmission of optical signal power through the transmission optical waveguide when the optical signal is substantially resonant with the optical resonator,

the transmission optical waveguide being a low-index planar lightwave transmission optical waveguide, the planar lightwave transmission optical waveguide being adapted for transverse-coupling.

125. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical waveguide structure, comprising the steps of:

depositing a layer structure on a substrate, the layer structure including a multi-layer reflector stack and an active layer; and

spatially-selectively processing at least a portion of at least one of the multi-layer reflector stack and the active layer so as to provide lateral confinement for a guided optical mode.

126. The method of Claim 125, further including the step of processing at least one side of the multi-layer waveguide structure to provide at least one layer of the multi-layer waveguide structure with at least one lateral lower-index portion.

127. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical waveguide structure, comprising the steps of:

depositing a layer structure on a substrate, the layer structure including a multi-layer reflector stack and an active layer;

spatially-selectively processing at least a portion of at least one of the multi-layer reflector stack and the active layer so as to provide lateral confinement for a guided optical mode; and

processing at least one side of the multi-layer waveguide structure to provide at least one layer of the multi-layer waveguide structure with at least one lateral lower-index portion,

the lateral lower-index portion being provided by oxidation of a lateral portion of the layer.

128. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical waveguide structure, comprising the steps of:

depositing a first layer structure on a first substrate, the first layer structure including a multi-layer reflector stack;

depositing a second layer structure on a second substrate, the second layer structure including an active layer;

securedly positioning the second substrate relative to the first substrate so as to substantially eliminate voids between the first and second layer structures;

removing the second substrate while leaving the at least a portion of the second layer structure; and

spatially-selectively processing at least a portion of at least one of the first and second layer structures so as to provide lateral confinement for a guided optical mode.

129. The method of Claim 128, further including the step of processing at least one side of the multi-layer waveguide structure to provide at least one layer thereof with at least one lateral lower-index portion thereof.

130. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical waveguide structure, comprising the steps of:

depositing a first layer structure on a first substrate, the first layer structure including a multi-layer reflector stack;

depositing a second layer structure on a second substrate, the second layer structure including an active layer;

securedly positioning the second substrate relative to the first substrate so as to substantially eliminate voids between the first and second layer structures;

removing the second substrate while leaving the at least a portion of the second layer structure;

spatially-selectively processing at least a portion of at least one of the first and second layer structures so as to provide lateral confinement for a guided optical mode; and

processing at least one side of the multi-layer waveguide structure to provide at least one layer thereof with at least one lateral lower-index portion thereof,

the lateral lower-index portion being provided by oxidation of a portion of the layer.

131. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical waveguide structure, comprising the steps of:

depositing a layer structure on a substrate, the layer structure including a first multi-layer reflector stack, a second multi-layer reflector stack, a core layer therebetween, and an active layer; and

spatially-selectively processing at least one of the first and second multi-layer-reflector stacks, the core layer, and the active layer, thereby providing lateral confinement for a guided optical mode.

132. The method of Claim 131, further including the step of processing at least one side of the multi-layer waveguide structure to provide at least one layer thereof with at least one lateral lower-index portion thereof.

133. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical waveguide structure, comprising the steps of:

depositing a layer structure on a substrate, the layer structure including a first multi-layer reflector stack, a second multi-layer reflector stack, a core layer therebetween, and an active layer;

spatially-selectively processing at least one of the first and second multi-layer-reflector stacks, the core layer, and the active layer, thereby providing lateral confinement for a guided optical mode; and

processing at least one side of the multi-layer waveguide structure to provide at least one layer thereof with at least one lateral lower-index portion thereof,

the lateral lower-index portion being provided by oxidation of a portion of the layer.

134. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical waveguide structure, comprising the steps of:
depositing a first layer structure on a first substrate, the first layer structure including a first multi-layer reflector stack;
depositing a second layer structure on a second substrate, the second layer structure including a second multi-layer reflector stack, at least one of the first and second layer structures including a core layer, at least one of the first and second layer structures including an active layer;
securedly positioning the second substrate relative to the first substrate so as to substantially eliminate voids between the first and second layer structures and so as to position the core layer between the first and second multi-layer reflector stacks;
removing one of the first and second substrates while leaving at least a portion of each of the first multi-layer reflector stack, the core, the second multi-layer reflector stack, and the active layer; and
spatially-selectively processing at least one of the first multi-layer reflector stack, the core layer, the second multi-layer reflector stack, and the active layer, thereby providing lateral confinement for a guided optical mode.

135. The method of Claim 134, further including the step of processing at least one side of the multi-layer waveguide structure to provide at least one layer thereof with at least one lateral lower-index portion thereof.

136. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical waveguide structure, comprising the steps of:
depositing a first layer structure on a first substrate, the first layer structure including a first multi-layer reflector stack;
depositing a second layer structure on a second substrate, the second layer structure including a second multi-layer reflector stack, at least one of the first and second layer structures including a core layer, at least one of the first and second layer structures including an active layer;

securedly positioning the second substrate relative to the first substrate so as to substantially eliminate voids between the first and second layer structures and so as to position the core layer between the first and second multi-layer reflector stacks;

removing one of the first and second substrates while leaving at least a portion of each of the first multi-layer reflector stack, the core, the second multi-layer reflector stack, and the active layer;

spatially-selectively processing at least one of the first multi-layer reflector stack, the core layer, the second multi-layer reflector stack, and the active layer, thereby providing lateral confinement for a guided optical mode; and

processing at least one side of the multi-layer waveguide structure to provide at least one layer thereof with at least one lateral lower-index portion thereof,

the lateral lower-index portion being provided by oxidation of a portion of the layer.

137. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical waveguide structure on a substrate, comprising the steps of:

depositing a first layer structure on a first substrate, the first layer structure including a first multi-layer reflector stack;

depositing a second layer structure on a second substrate, the second layer structure including a second multi-layer reflector stack;

depositing third layer structure on a third substrate, the third layer structure including an active layer, at least one of the first, second, and third layer structures including a core layer;

securedly positioning the third substrate relative to the first substrate so as to substantially eliminate voids between the first and third layer structures;

removing the third substrate while leaving at least a portion of the active layer;

securedly positioning the second substrate relative to the first substrate so as to substantially eliminate voids between the second and third layer structures and so as to position the core layer between the first and second multi-layer reflector stacks;

removing the second substrate while leaving at least a portion of the second multi-layer reflector stack; and

spatially-selectively processing at least one of the first multi-layer reflector stack, the core layer, the second multi-layer reflector stack, and the active layer, thereby providing lateral confinement for a guided optical mode.

138. The method of Claim 137, further including the step of processing at least one side of the multi-layer waveguide structure to provide at least one layer thereof with at least one lateral lower-index portion thereof.

139. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical waveguide structure on a substrate, comprising the steps of:

depositing a first layer structure on a first substrate, the first layer structure including a first multi-layer reflector stack;

depositing a second layer structure on a second substrate, the second layer structure including a second multi-layer reflector stack;

depositing third layer structure on a third substrate, the third layer structure including an active layer, at least one of the first, second, and third layer structures including a core layer;

securedly positioning the third substrate relative to the first substrate so as to substantially eliminate voids between the first and third layer structures;

removing the third substrate while leaving at least a portion of the active layer;

securedly positioning the second substrate relative to the first substrate so as to substantially eliminate voids between the second and third layer structures and so as to position the core layer between the first and second multi-layer reflector stacks;

removing the second substrate while leaving at least a portion of the second multi-layer reflector stack;

spatially-selectively processing at least one of the first multi-layer reflector stack, the core layer, the second multi-layer reflector stack, and the active layer, thereby providing lateral confinement for a guided optical mode; and

processing at least one side of the multi-layer waveguide structure to provide at least one layer thereof with at least one lateral lower-index portion thereof,

the lateral lower-index portion being provided by oxidation of a portion of the layer.